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Comparisons between NESS and Wisconsin Cloud-Tracked Winds

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1. Introduction

The types of observations to be included in Level II and Level III data sets generated for the NASA Data Systems Test (DST) include

- -- surface-based observations received normally at NMC,
- -- operational satellite sounding data generated by NESS,
- -- winds generated by NESS from SMS imagery,
- -- experimental satellite soundings generated from Nimbus data by GISS, and
- -- experimental winds produced from SMS data by SSEC[1], University of Wisconsin.

In May 1974, we ran an extended test of the system for producing DST data sets (O'Neil, Bonner and Desmarais, 1974). All of the data systems listed above were included in this test--except for the winds generated by the University of Wisconsin. In October 1974, we participated in a much more limited test, involving only the Wisconsin winds. Winds derived in real time by SSEC were transmitted to GISS. GISS reformatted the data and transmitted it to NMC via the NESS-GISS data link. We merged the Wisconsin winds with surface-based observations and operational satellite data, producing a series of Level II data sets. The purpose of this test was to examine the procedures for transmitting and archiving Wisconsin wind data within the operational deadlines established for the DST and to provide, to the extent that we could, some assessment of the quality of these winds.

The success of the experiment with respect to transmission and archiving of data is discussed in an earlier report (O'Neil, 1974; see attachment). This report describes a very limited attempt to compare these observations with rawin reports and with NESS-derived winds.

As Hubert and Whitney (1974) have pointed out, there is no way to measure <u>directly</u> the accuracy of satellite winds. We can only ask

- -- Are they consistent with each other and with other types of data?
- -- Do they lead to reasonable, smooth synoptic-scale wind analyses?

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[1] Space Science and Engineering Center

Section 2 of this report describes very briefly the techniques used at NESS and at Wisconsin for deriving cloud-tracked winds. Section 3 presents hand-analyzed streamline patterns derived from NESS winds, from Wisconsin winds, and from conventional data. The deviation between observations and some smoothed synoptic-scale analysis of the data is a measure, to some degree, of the error and small-scale variability inherent in the observations. Section 4 describes deviations between NESS and Wisconsin winds and analyses produced from these winds--using an automated analysis scheme developed by A. Thomasell of NESS (see Hubert and Whitney, 1974). Section 5 presents comparisons between satellite winds and "co-located" rawin reports. A final section describes some possible sources of error in the Wisconsin-derived winds.

All analyses and comparisons are based upon winds from two observation times: 1200 GMT 30 October and 1200 GMT 31 October. Both automated and hand analyses were constructed only at "high" and at "low" levels.

2. NESS and Wisconsin Systems for Generating Winds

The two systems for deriving winds are similar in that they measure cloud displacements from satellite cloud images and assume that these displacements are produced by the wind.

The NESS system uses two different methods for determining winds. Most low-level vectors are determined in a completely automated fashion (see Leese, et. al., 1971) by cross-correlation techniques using pairs of either visual or infrared photos. Winds are calculated only over ocean areas from 35N to 35S at pre-assigned points on a 2½ degree grid. Vectors are manually edited to eliminate middle and high cloud motions. The remaining "low-level" winds are assigned pressures of 900 mb.

High-level winds are determined from manual tracking of selected cloud elements appearing in projected film loops--made from sequences of visible or IR images (Hubert and Whitney, 1971; Young, Doolittle and Mace, 1972). Winds from SMS film loops are assigned pressure altitudes inferred from equivalent black body temperatures. Temperatures are converted to pressures by using 12-hour-old NMC temperature analyses.

The McIDAS (Man-Computer Interactive Data Processing System) cloud-tracking system developed at the University of Wisconsin generates winds from picture pairs or triplets of pictures. In this system, an operator uses a video display unit to select and track targets which may be individual clouds or features of clouds. Displacements may be determined by a variety of techniques including both manual tracking and cross-correlations. The temperature of the target is determined from its black body temperature and from its emissivity as estimated from visible and IR data. Temperature is related to pressure by use of climatological profiles stratified by season and latitude.

At the time of the test, NESS winds were being computed from both SMS and ATS photos. High-level SMS winds were determined from 2 by 4 mile resolution IR data; automated picture pair winds used 2 x 2 visible data. Pressure altitudes were computed for SMS high-level winds; however, there were problems in placing this information in the NMC files. High-level winds, as available to us, had been assigned a fixed pressure altitude of 300 mb.

Wisconsin winds were determined entirely from SMS 1--using ½ mile resolution visible data. Pressures were assigned to the nearest 50 mb.

3. Manual Streamline Analyses

Wisconsin and NESS winds were separated into low-level and high-level winds, wind vectors were plotted on Mercator projections extending from 40N to 40S, and streamlines were drawn based on available observations from each data set. Winds assigned pressure levels of 950, 900, or 800 mb were considered to be low-level winds; high-level winds included observations at 300 and 200 mb.

3.1 30 October 1974

Streamlines from low-level winds are presented in figures 1, 2 and 3. The satellite picture at analysis time is shown for reference in figure 4.

The NESS low-level winds are plotted in figure 1. Winds that are not regularly spaced are from ATS photos near 1600 GMT. The coverage is quite complete, except in the areas of extensive high-level cloud cover to the east of South America and to the southeast of Bermuda (figure 4). The vortex drawn at 28N 55W is consistent with peripheral winds, but the streamline pattern in this area is inferred largely from the instantaneous cloud structure on the satellite photo.

The analysis of low-level Wisconsin winds (figure 2) shows a similar pattern, with easterly or northeasterly winds over the eastern North Atlantic. Streamlines drawn in the regions with data indicate

-- strong southwesterly winds east of South America,

-- an anticyclonic vortex near 20S, and

-- cyclonic circulation to the southeast of Bermuda.

The wind coverage is less complete than the coverage provided by NESS winds. However, this is to be expected because the Wisconsin system is geared more towards concentrated coverage in what may be critical areas than to providing a regular array of satellite winds. Major gaps in the two sets of data appear in about the same locations. The vortex near 28N 55W is poorly defined by both NESS and Wisconsin low-level winds.

The NESS-derived winds were manually edited before they were made available to NMC and other users. Almost all observations appear to fit a regular, horizontally consistent pattern. This is not the case for individual Wisconsin winds. The four southerly winds between 35 and 40N (circled in figure 2) are not consistent with several neighboring winds, with the surface reports in figure 3, or with NESS-derived winds. These winds would be believable if they were located about 10 degrees further south. It seemed likely that their positions were in error because of problems in data transmission or data formatting; however, this proved not to be the case. Locations of these winds in listings obtained from SSEC coincided with positions plotted in figure 2. If these positions are wrong, the error is in the system at SSEC. The two circled wind reports near the Cape Verde Islands are probably wrong. The raob winds and ship winds in this region are from the northeast (figure 3).

High-level wind analyses for this case are shown in figures 5, 6 and 7. Wind coverage is much less complete than for the low-level winds. However, the streamline pattern from 15N to 30N over most of the Atlantic is quite clearly defined. The NESS wind analysis (figure 5) agrees closely with the analyses produced from rawin and aircraft reports (figure 7). The wave pattern shown is consistent with the orientation of cirrus clouds in the satellite photo (figure 4b).

The Wisconsin wind analysis (figure 6) is very different in this area. The two easterly winds at 33 and 35N in the central Atlantic are not consistent with either the NESS-derived winds or the aircraft reports. The small area of bright clouds in the satellite photo (figure 4) near 30N, 65 to 70W, suggests the presence of a high-level vorticity maximum to the west of the surface trough (figure 3). The maximum is clearly defined by three aircraft reports between 25 and 30N (figure 7) and suggested, at least, by a NESS wind determination at 26N 63W. No winds were available in the region from the University of Wisconsin, although it appears that winds could have been determined from the visible data.

3.2 <u>31 October 1974</u>

Low-level streamline analyses are presented in figures 8, 9 and 10. The vortex between 25 and 30N is clearly defined by surface reports (figure 10) and by NESS low-cloud winds (figure 8). The center of this vortex is located just to the south of a cirrus cloud shield (figure 11a and 11b) and low-level vectors were successfully determined by the NESS automated technique. Five southwesterly winds north and east of this vortex represent middle and high-cloud winds; these are picture pair vectors which should have been deleted by the manual editing routine.

The position of the vortex in the analysis of Wisconsin winds (figure 9) is quite clearly indicated by the westerly wind at 26N 58W. Analyses shown in figures 8, 9 and 10 are essentially the same; both types of satellite-derived winds appear to be internally consistent and consistent with each other. Only a few Wisconsin winds appear to be in error. The northwesterly wind near the Cape Verde Islands (17N 24W) is not consistent with the surface observations or with the nearby rawin report. The southeasterly wind at 10N 32W is difficult to draw for, as is the northerly wind over Brazil at 09S 63W.

High-level winds are shown in figures 12, 13 and 14. Winds are provided by NESS and by Wisconsin in similar amounts and in essentially the same areas. The data, in general, are not sufficient to define streamline patterns with any degree of certainty. However, in regions with data, the NESS winds (figure 12) and rawin and aircraft winds (figure 14) are consistent with each other and in general agreement with the previous analysis. Several of the aircraft winds--particularly those at 36N 39W and 31N 50W--appear to be incorrect or, at least, unrepresentative.

The high-level Wisconsin winds over the subtropical North Atlantic lead to a streamline analysis which disagrees with both aircraft plus rawin and NESS wind analyses. The upper-level vortex to the south of Bermuda (figures 12 and 14) is mislocated in the Wisconsin wind analysis. Easterly winds at 28N 65W and 29N 63W appear in the Wisconsin data set (figure 13) to the south of the vortex in what must be westerly flow. The northwesterly wind at 25N 60W is clearly incorrect. The southeasterly flow indicated in the Western Atlantic between 10 and 20N is not consistent with NESS and aircraft reports or with the orientation of high clouds on the infrared photo (figure 11b). The 105-knot wind located at 27N 33W is probably too strong. A report at the same level, 165 km further south, is from the same direction with a speed of 50 knots. The anticyclonic shear implied by these winds is about 1.7×10^{-4} sec^{-1}--more than twice the value of the Coriolis parameter at this latitude.

4. Automated Analyses

Using an analysis scheme provided by NESS, high-level and low-level analyses were produced using all satellite winds. The analysis scheme interpolates u and v components to a 2.5 degree grid--using as additional information, the gradients implied by some first-guess field. An optional error check procedure involves the following steps:

1. Do a preliminary analysis using all of the data.
2. Compute the divergence and vorticity of this preliminary analysis.
3. Smooth the divergence and vorticity patterns to remove irregularities produced by "singular" observations.
4. Integrate the smoothed divergence and vorticities to obtain smoothed values of u and v.
5. Interpolate these smoothed values to the locations of wind observations. Delete all observations which differ from the smoothed values by more than some specified amount.

A new analysis is produced using only those observations which pass the error check (step 5).

Analyses were made, with and without error checks, on each of the two days. First-guess fields were provided by NMC "Flattery"[2] wind analyses from operational data sets; 850-mb and 250-mb analyses were used for low- and high-level flow, respectively. Data included all NESS and Wisconsin high- or low-level winds.[3] The effect of conventional observations is included indirectly through the first-guess fields.

Figures 15 and 16 show low-level analyses based upon satellite winds at 1200 GMT 31 October. Figure 15 is without error checking; figure 16 is with winds deleted which failed the error check routine. Notice that the analysis in figure 15 has attempted to draw for the NESS winds that should have been deleted (circled in figure 8) and for the questionable Wisconsin winds near the Cape Verde Islands (figure 9). In the latter case, there is a single, 20-knot northwesterly wind that, even if real, would represent a scale of variation we would not like to retain. The analysis in figure 16 has eliminated these winds. Synoptic scale features are retained, yet the flow is more regular. The vortex near Bermuda is much more symmetric--in agreement with the surface analysis in figure 10.

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[2] Spectral global analyses produced twice daily at 0000 and 1200 GMT.

[3] At the suggestion of L. Hubert of NESS, the definition of a low-level wind was changed to include Wisconsin 700-mb winds.

Mean and root-mean-square vector deviations between NESS and Wisconsin winds and analyses with error checking are summarized in Tables 1 and 2. Deviations are given in knots. Vector differences are of the order of 2 to 2.5 knots at low levels (Table 1), 4.5 to 5 knots at high levels (Table 2). Differences are approximately the same for both sets of data. Results suggest that the non-systematic error or noise in both data sets is small, that observations which pass the error-check procedures can be fit--to within a few knots--by a smoothed synoptic-scale analysis.

Table 3 shows the percentages of observations that were rejected in each case by the error check routine. The table supports our earlier subjective conclusion that the Wisconsin data sets contain a relatively large number of questionable winds. The criteria used may have been too restrictive, but they were the same for both data sets. The percentage of low-level winds rejected is about twice as large for Wisconsin as for NESS winds.

Table 1. Vector deviations in knots. Low-level winds.

CASE	MEAN $\vec{V}'$ NESS	MEAN $\vec{V}'$ WISC	RMS $\vec{V}'$ NESS	RMS $\vec{V}'$ WISC	N NESS	N WISC
12 GMT 30 OCT	2.1	2.5	2.8	3.0	318	160
12 GMT 31 OCT	2.2	2.2	3.2	2.7	367	176
AVG	2.2	2.4	3.0	2.9	343	168

Table 2. Vector deviations in knots. High-level winds.

CASE	MEAN $\vec{V}'$ NESS	MEAN $\vec{V}'$ WISC	RMS $\vec{V}'$ NESS	RMS $\vec{V}'$ WISC	N NESS	N WISC
12 GMT 30 OCT	4.5	4.9	5.5	6.0	123	52
12 GMT 31 OCT	4.5	4.6	5.4	5.7	74	62
AVG	4.5	4.8	5.5	5.9	99	57

Table 3. Percentage of observations deleted by error check routine.

CASE	LOW LEVELS NESS	LOW LEVELS WISC	HIGH LEVELS NESS	HIGH LEVELS WISC
12 GMT 30 OCT	9.1	20.4	16.9	21.2
12 GMT 31 OCT	9.8	18.5	17.8	22.5
AVG	9.5	19.5	17.4	21.9

5. Comparisons with Co-located Rawin Reports

Differences between satellite-derived winds and "co-located" rawin reports were computed separately for limited samples of NESS and Wisconsin winds. The maximum separation permitted between satellite and rawin reports was 2 degrees latitude (roughly the same as the 150-mile limit used by Hubert and Whitney, 1971). The time separation was small--about 1 hour for Wisconsin winds, 2 to 4 hours for NESS wind reports. We tried to select pairs of stations where the differences due to horizontal wind shear would be relatively small.

Table 4 shows the mean and root-mean-square vector differences computed between satellite winds and rawin reports. NESS and Wisconsin winds are compared with rawinsonde observations. Differences cannot be interpreted as errors in the satellite winds. The difference between any pair of observations reflects

- -- the error in the rawin report,
- -- the error in the satellite wind, and
- -- the actual variation in wind due to space and time separations between the "co-located" reports.

However, comparison of the differences between NESS-rawin and Wisconsin-rawin pairs should give some indication of the relative accuracy of the two data sets.

Mean differences are about 9 knots at low levels for both NESS and Wisconsin reports. As might be expected, the differences are larger at high levels where wind speeds are stronger. The mean vector difference for high-level Wisconsin winds is about 28 knots, nearly twice as large as for the NESS-rawin comparisons.

Some of the winds included in these comparisons are reports which had been rejected by the analysis codes (section 4). If these winds are eliminated from the sample, see Table 5, mean vector differences are about 7 knots for low-level vectors, 11 and 22 knots for NESS and Wisconsin high-level winds.

The different results obtained for NESS and Wisconsin high-level winds is brought out more clearly in Table 6 which shows frequency distributions of the magnitudes of individual vector differences between satellite winds and rawin reports. Columns labelled A and B are for samples used in Tables 4 and 5, respectively. Notice that the error check routine used in the analysis code does, in general, delete those reports where rawin-satellite differences were largest even though the rejections were made without direct use of the rawinsonde reports. In the original sample (column A, Table 6), 8 of 16 NESS high-level winds agree within 10 knots with the nearby rawin observation; 13 of 17 Wisconsin reports showed vector deviations of more than 20 knots.

Table 7 shows deviations between rawin reports and high-level Wisconsin winds where comparisons were made at 300 mb and at some Level of Best Fit (Hubert and Whitney, 1971). The Level of Best Fit was defined as that level within 300 mb of the reported pressure altitude which gave the smallest vector difference between the satellite wind and rawin report.

Notice that the differences with rawin reports are reduced slightly by assuming that all Wisconsin winds are valid at 300 mb instead of at the level assigned. Differences are, of course, greatly reduced when comparisons are made at the Level of Best Fit.

Hubert and Whitney (1971) have noted that the greatest source of error in high-level winds is likely to arise from the difficulty in assigning accurate heights to the satellite winds. In order to estimate how large this error might be, we computed, from rawin reports used in Table 5, the mean and root-mean-square vector differences between winds 50 mb apart in the range from 300 to 200 mb. Results, shown in Table 8, represent the differences which would have been observed if satellite and rawin reports were exactly the same, but the altitude of the satellite wind was in error by 50 mb. Differences are somewhat higher for rawin reports used in Wisconsin than in NESS comparisons. The root-mean-square vector difference for the NESS sample is about 12 knots--which corresponds closely to the differences observed in Table 5. Thus, differences between co-located NESS high-level winds and rawin reports can be accounted for entirely by errors of 50 mb or less in specifying the heights.

Table 4. Rawin-Sat wind comparisons. Vector differences in knots.

TYPE	LEVEL	$\vec{V}'$	RMS $\vec{V}'$	N
NESS	LOW	8.7	9.7	38
WISC	LOW	9.0	11.1	33
NESS	HIGH	14.4	18.8	16
WISC	HIGH	28.0	30.9	17

Table 5. Rawin-Sat wind comparisons with stations eliminated which were rejected by the analysis code. Vector differences in knots.

TYPE	LEVEL	$\vec{V}'$	RMS $\vec{V}'$	N
NESS	LOW	7.3	8.1	32
WISC	LOW	6.1	6.7	26
NESS	HIGH	10.7	12.1	14
WISC	HIGH	22.2	24.5	12

Table 6. Frequency distributions of individual vector deviations (magnitudes in knots) between NESS and Wisconsin high-level vectors and rawin reports. (A) Sample used for mean and root-mean-square deviations in Table 4. (B) Reduced sample used in Table 5.

VECTOR DIFFERENCE (KTS)	A		B	
	NESS	WISC	NESS	WISC
0-10	8	1	8	1
11-20	5	3	5	3
21-30	2	8	1	7
> 30	1	5	0	1
TOTAL	16	17	14	12

Table 7. High-level Wisconsin wind-rawin comparisons with the level of comparison selected in three different ways. Deviations in knots.

LEVEL OF COMPARISON	$\vec{V}'$	RMS $\vec{V}'$	N
Level Assigned	22.2	24.5	12
300 mb	17.6	21.3	12
Level of Best Fit	11.6	14.1	12

Table 8. Vector differences in knots between winds at 200 and 250 mb and 250 and 300 mb from rawin reports used in comparisons with NESS and Wisconsin satellite winds.

SAMPLE	$\vec{V}'$	RMS $\vec{V}'$	N
NESS	10.2	11.6	23
WISC	10.9	15.3	24

6. Comments on Individual Winds

In the hope that we might be able to provide useful feedback to NESS and Wisconsin, we examined as carefully as we could individual winds which appeared to be in error. Comments are based on examination of film loops and rawinsonde reports. The discussion will be limited to the circled reports in figures 2, 6, 8, 9, 12 and 13.

6.1 Figure 2

Reports near 38N 51W appear, as mentioned earlier, to have been located incorrectly. If placed 10 degrees further south, these winds fit--in fact describe--the closed circulation which was clearly apparent from the SMS film loop.

The two northwesterly winds near the Cape Verde Islands are located in what appears from other sources to be northeasterly flow (see figures 1 and 3). Altitudes assigned to these winds were 800 and 900 mb. A rawinsonde report located close to these winds shows northeasterly Trades extending to about 750 mb. Winds are northwesterly throughout the mid troposphere, and it seems likely that the actual targets in this case were mid-level clouds near 400 mb (see also figure 4b).

6.2 Figure 6

With M. Young of NESS, we used the SMS film loop to recompute high-level winds at the locations of the six circled reports in the central Atlantic. Wisconsin winds and our winds at these locations are listed in Table 9.

Table 9. Wisconsin and film-loop winds at critical locations in figure 6. Wind speeds and vector differences are in knots.

VECTOR NUMBER	LAT.	LONG.	ALT.	WISC.	FILM LOOP	VECTOR DIFF.
1	32.9N	44.5W	300	115/17	310/40	57
2	35.1N	52.6W	200	122/35	250/55	81
3	21.4N	42.1W	200	351/17	300/35	28
4	20.2N	59.6W	200	231/15	230/40	25
5	26.0N	54.0W	300	181/25	210/25	13
6	25.9N	36.5W	300	309/15	270/30	21

The regular, large-scale wave pattern shown in figures 5 and 7 was clearly apparent from the film loop. Most of the errors in this case appear to result from errors in the altitudes assigned to the winds. Notice the close agreement between Wisconsin vectors 1, 4 and 5 (Table 9) and the NESS low-level winds (figure 1). Although we have no clear evidence for this, vectors 3 and 6--like the northwesterly winds near the Cape Verde Islands (figure 2)--are probably representative of some mid-level flow.

6.3 Figure 8

As stated in section 3, the circled NESS winds should have been deleted by the manual editing routine. It is clear from the infrared picture (figure 11b) and from the film loop that these are not low-level winds.

6.4 Figure 9

The northwesterly wind at 17N 24W, with a pressure assigned of 900 mb, is not representative of the low-level flow. The report from a nearby radiosonde station (figure 17) shows northeasterly winds from the surface to 700 mb with a southwesterly wind at 500 mb. The most likely target elevation is about 600 mb--beneath a stable layer in the sounding. The wind at this level would be from the northwest.

The circled report at 10N 32W is a southeasterly wind imbedded in northwesterly flow. Cumulus clouds in this area appeared to be growing; the apparent displacements may not have been due entirely to the wind.

At 09S and 63W, the circled 900-mb wind is from 330 degrees at 36 knots. Surface reports in this area showed only broken middle and high clouds (see also figure 11b). The report agrees closely with nearby high-level winds (figure 12). It seems likely that there was a gross error in computing or transmitting the level of this wind.

6.5 Figure 12

The five circled reports near 36N 60W appear from the infrared photo (figure 11b) and the film loop to be middle-cloud winds.

6.6 Figure 13

The two southeasterly winds near 13N 58W are in a region that appears--from the NESS wind analysis (figure 12) and from a nearby rawinsonde wind (figure 14)--to have southwesterly flow at cirrus cloud levels. The low-level flow in this area is from the southeast (figures 8, 9 and 10), and it appears that these vectors are actually low-level winds. In this particular area, we received seven Wisconsin winds, valid at the same time, with pressures assigned ranging from 900 to 100 mb. Each of these winds was located within about 300 km of a single rawin report (see figure 18). Figure 19 shows the wind hodograph at this station and the seven Wisconsin reports. It seems fairly obvious from the diagram that all of the vectors--including those assigned pressures of 500, 300, 200 and 100 mb--represent low-level winds. Similarly, the circled high-level vectors between 22 and 28N appear, for the most part, to be low-level winds. Notice how well these vectors fit the low-level streamline analyses shown in figures 8, 9 and 10.

The circled 300-mb wind at 13S 66W appears to be located about 10 degrees too far north.

7. Summary and Conclusions

We see no reason not to believe that satellite-derived winds are as accurate as rawinsonde winds--provided that targets are carefully selected and that the level of the wind is accurately determined.

NESS-derived winds appear to us to be remarkably good. The automated picture-pair system gives excellent broad-scale coverage for defining the low-level flow. Post-editing procedures are essential with this system. Because the editing leaves gaps in the data, efforts should be made to fill in these gaps, where this is possible, with manually-derived winds.

Low-level winds provided by Wisconsin appeared to be at least as accurate as those produced by NESS. Wisconsin data sets, however, contained a relatively large number of questionable winds. Errors in the Wisconsin winds appeared to arise from three different sources:

1. Errors in position

2. Gross errors in heights

3. Improper target selection

Of about 46 questionable winds examined in some detail, 5 of the "errors" were attributed to errors in position, 23 to the assignment of incorrect altitudes, and 4 to poor target selection. No judgment could be made in the remaining 14 cases. The system for determining target elevations is relatively sophisticated, and it seems likely that these errors--and location errors--were associated with hardware or software problems in processing the data.

The Wisconsin wind system has the ability to derive wind vectors in areas with multiple cloud layers where determinations are difficult or impossible with the lower resolution data used by NESS. These winds should be a useful addition to the DST data base. We would like to suggest, however, that their value could be increased by

-- emphasizing rules developed at NESS for target selection,

-- including limited procedures for quality control.

Procedures should be worked out with NESS for minimizing redundancies in the two data sets.

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Archiving SMS-A winds produced by the Space Science and Engineering Center (SSEC), University of Wisconsin

Hugh O'Neil

A 5-day period, October 28-November 1, was set up by the NASA DST operations group to archive SMS-A derived winds. These winds were produced by SSEC using the MACIDAS system and transmitted to GISS. GISS reformatted the data and set it on to NMC. The Data Assimilation Branch (DAB) at NMC received the data and merged it with the conventional NMC reports. This report covers the highlights of the test: (1) transmissions from GISS, (2) merging the data on the NOAA IBM 195 computer, and (3) number of SSEC wind reports received.

(1) Transmissions from GISS

The scheduled transmission times were 02-03 Local for 12Z data and 08-09 Local for 18Z data. The transmissions were actually received, according to the NESS log, as follows:

12Z/28 -- 29/0215
18Z/28 -- 29/0915
18Z/29 -- 30/1457
12Z/30 -- 31/0246
18Z/30 -- 31/0905 (retransmission 1655)
12Z/31 -- 01/0250 (retransmission 0954)
18Z/31 -- 01/1114

Of the seven scheduled transmissions received, five were on schedule, one was about 6 hours late, and one was about 3 hours late. The late transmissions were the result of phone line problems at GISS. SSEC had the data ready to transmit on time but could not make connections with GISS.

Winds for 12Z/29, 12Z/1, and 18Z/1 were not produced by SSEC due to equipment problems. As a result, the 12Z/29 sequence was missed and the test was terminated a day early. DAB had trouble with three transmissions: 18Z/29, 18Z/30, and 12Z/31. In each case, the date on the processing printout did not agree with the date GISS said they were transmitting. Two retransmissions were necessary to correct these problems.

We have looked into this and determined that GISS did send the correct data, but that operators at NESS mounted wrong tapes at processing time on the 195 computer. This problem will be resolved the next time we do a test by closer monitoring of NESS activities and by establishing a more rigorous tape accounting procedure.

(2) 195 Processing

For each data set processed, we ran three 195 programs: one to collect the conventional ADP data, one to process the Wisconsin data, and one to merge these two data sets onto an archive tape. All three programs worked fine during the test. Turnaround on the 195, using priority 5, was excellent. No problems were experienced processing on the 195.

(3) Number of Reports Received at NMC

	Northern Hemisphere	Southern Hemisphere	Total
12Z/28	303	66	369
18Z/28	291	8	299
18Z/29	358	6	364
12Z/30	201	174	375
18Z/30	391	21	412
12Z/31	209	190	399
18Z/31	341	14	355

The number of reports processed per level are as follows:

	950	900	800	700	600	500	400	300	200	100
12Z/28	28	81	43	29	39	41	30	35	39	4
18Z/28	19	100	63	23	21	16	12	24	13	3
18Z/29	36	110	52	27	22	16	42	33	21	5
12Z/30	27	79	59	36	24	34	39	27	39	11
18Z/30	26	154	68	44	29	20	22	31	13	6
12Z/31	10	55	95	56	27	33	32	52	28	11
18Z/31	9	60	74	85	36	20	15	31	18	7

SSEC transmitted the following number of reports to GISS:

12Z/28	369
18Z/28	342
18Z/29	366
12Z/30	375
18Z/30	414
12Z/31	399
18Z/31	355

The differences between the number of reports transmitted to GISS by SSEC and those received by us from GISS are: 43 (18Z/28), 2 (18Z/29), and 2 (18Z/30). Mr. Carus at GISS looked into the causes for these differences. He concluded that the data counts are different because SSEC sent some duplicate reports, in particular 43 of them on the 28th. All of the unique data generated by SSEC did reach NMC and was included in the DST archive.

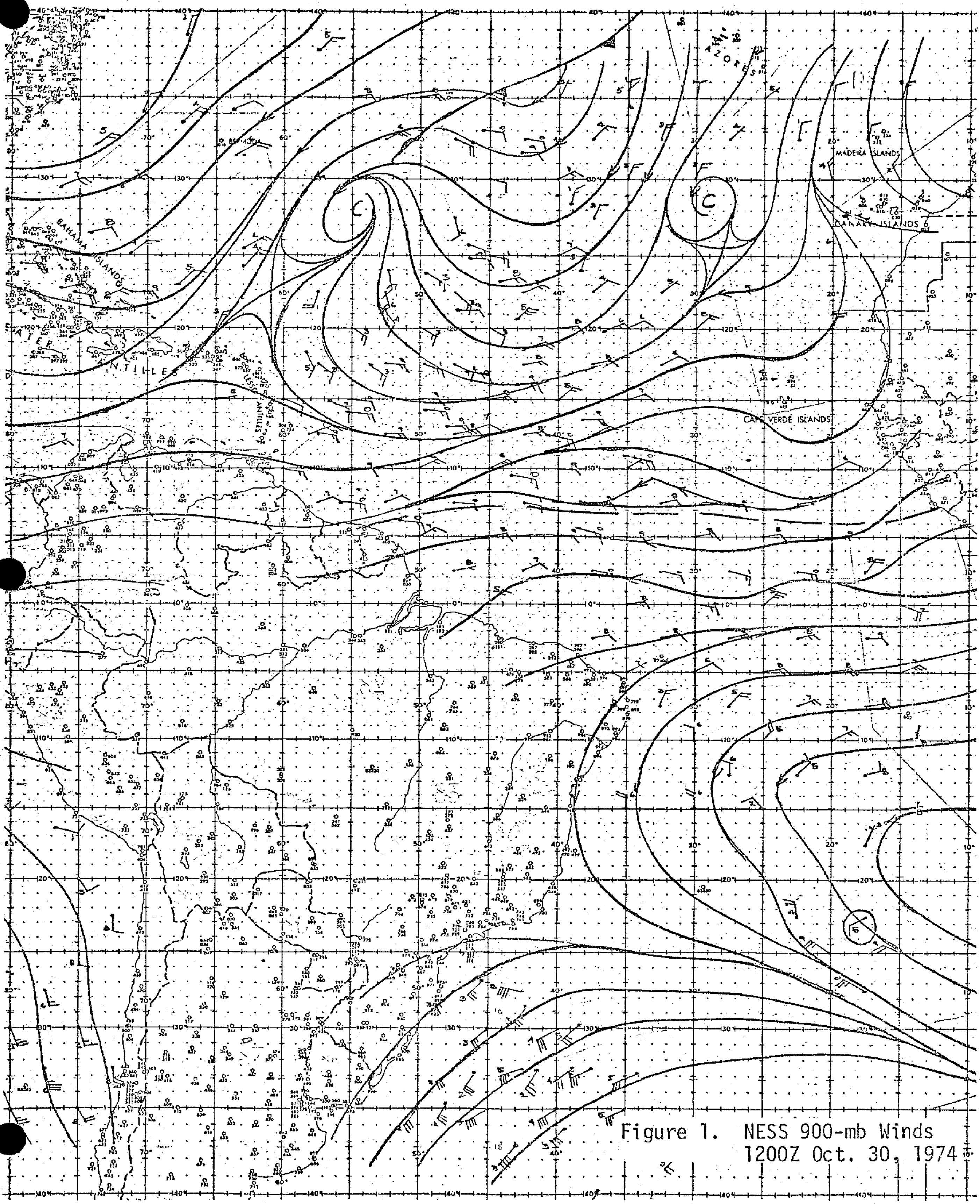


Figure 1. NESS 900-mb Winds
1200Z Oct. 30, 1974

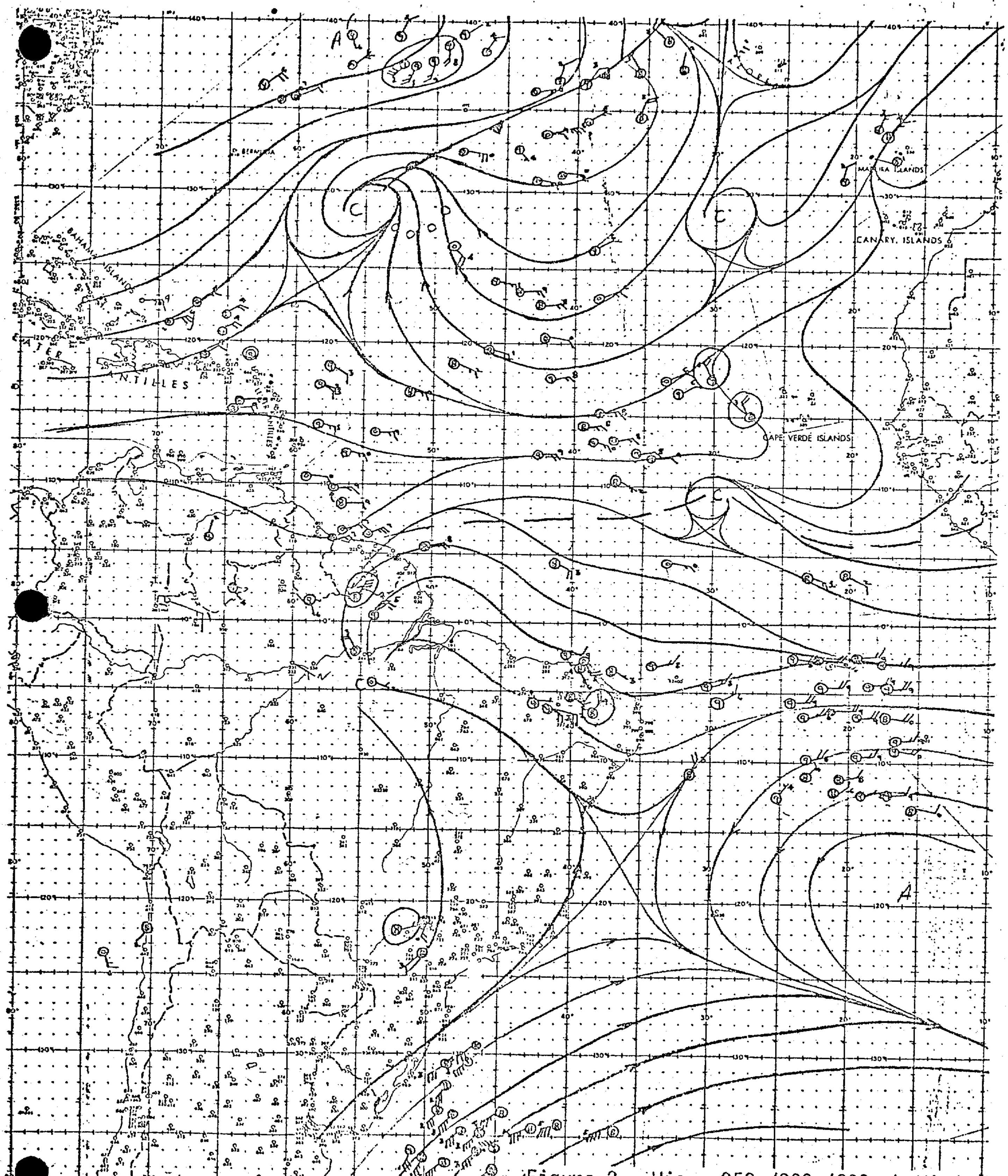


Figure 2. Wisc. 950-/900-/800-mb Winds
1200Z Oct. 30, 1974

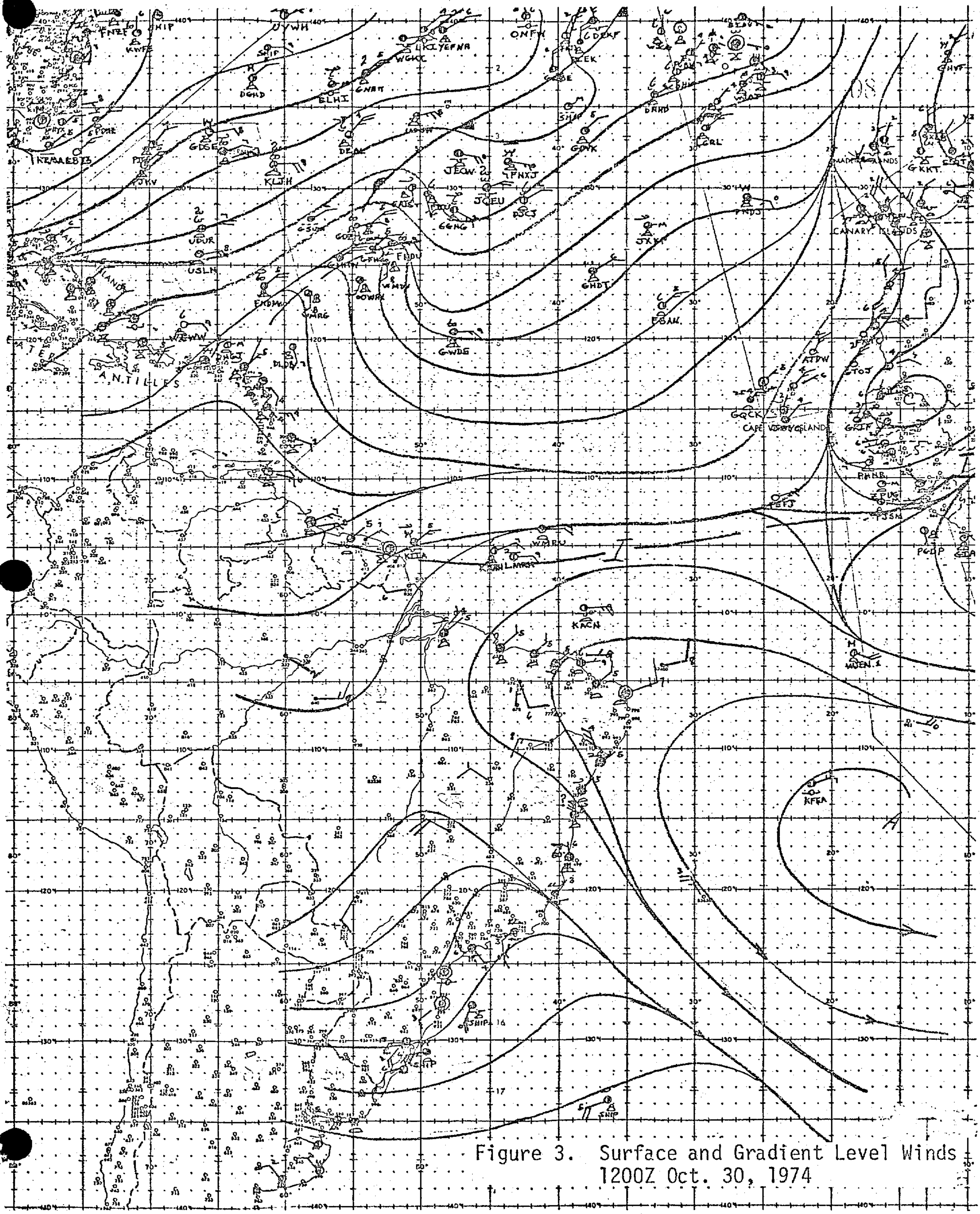


Figure 3. Surface and Gradient Level Winds
1200Z Oct. 30, 1974

Figure 4a. SMS 1 Visible Range 2 n mi Resolution
1200Z Oct. 30, 1974

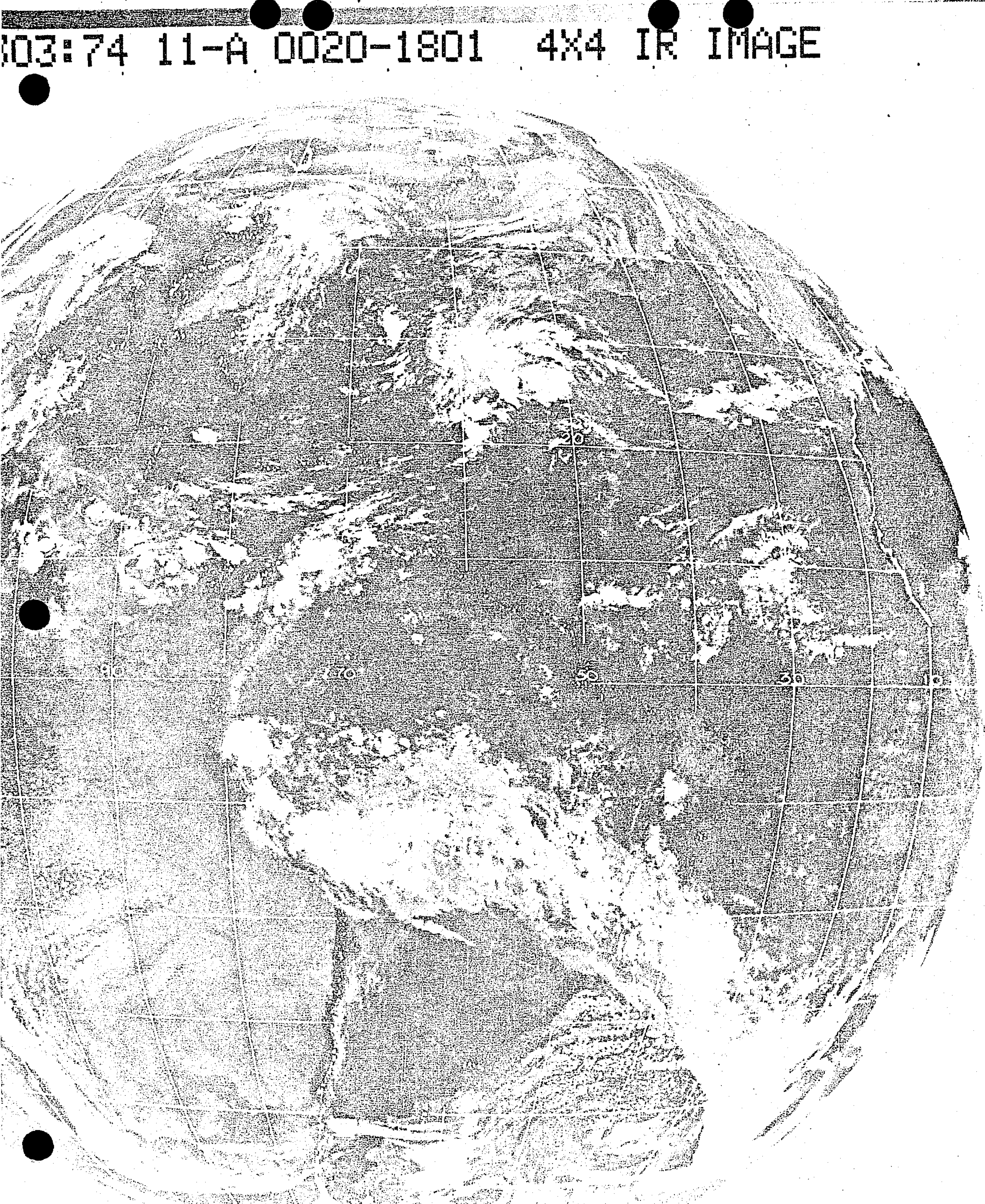


Figure 4b. SMS 1 Infrared Range 4 n mi Resolution
1200Z Oct. 30, 1974

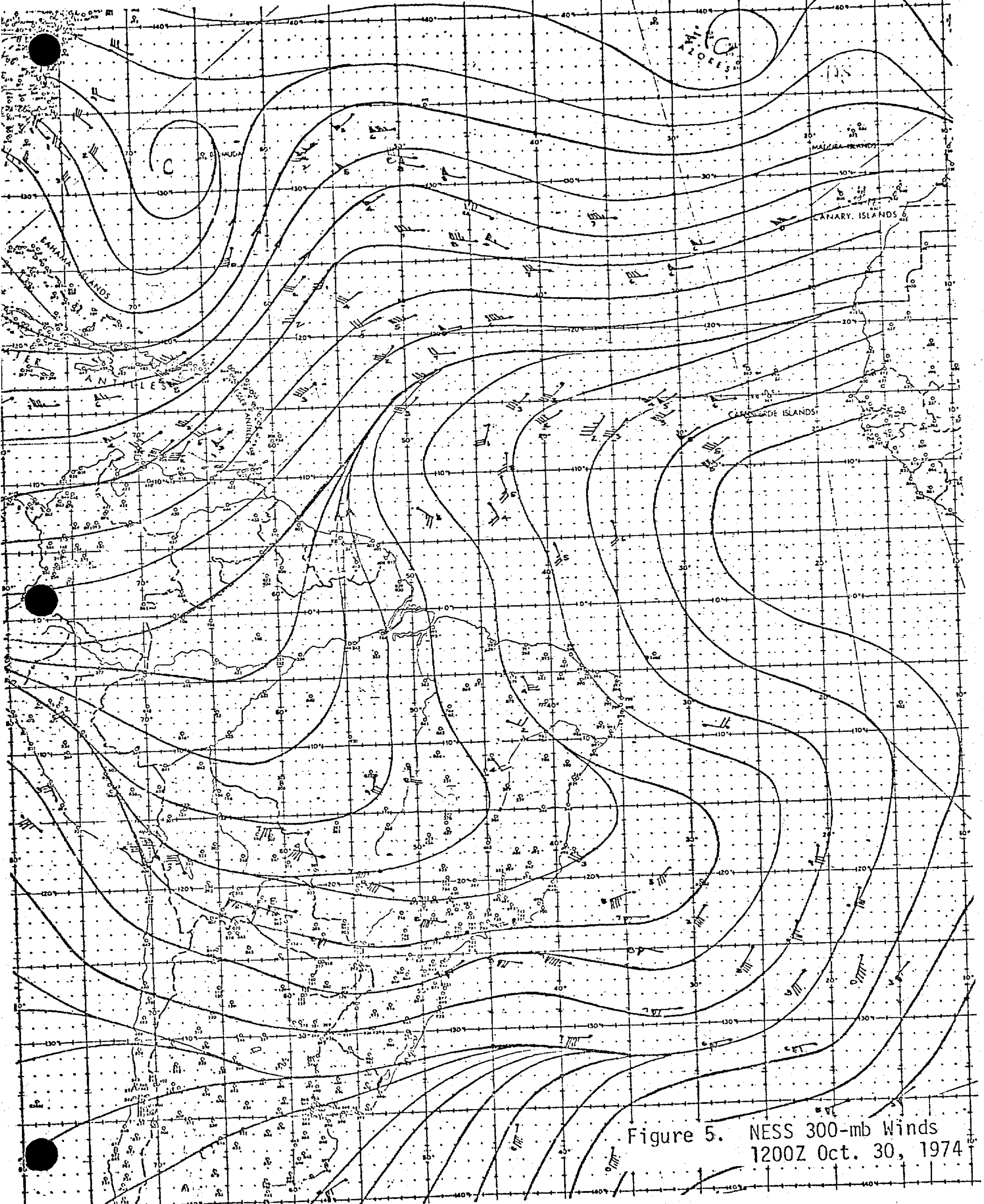


Figure 5. NESS 300-mb Winds
1200Z Oct. 30, 1974

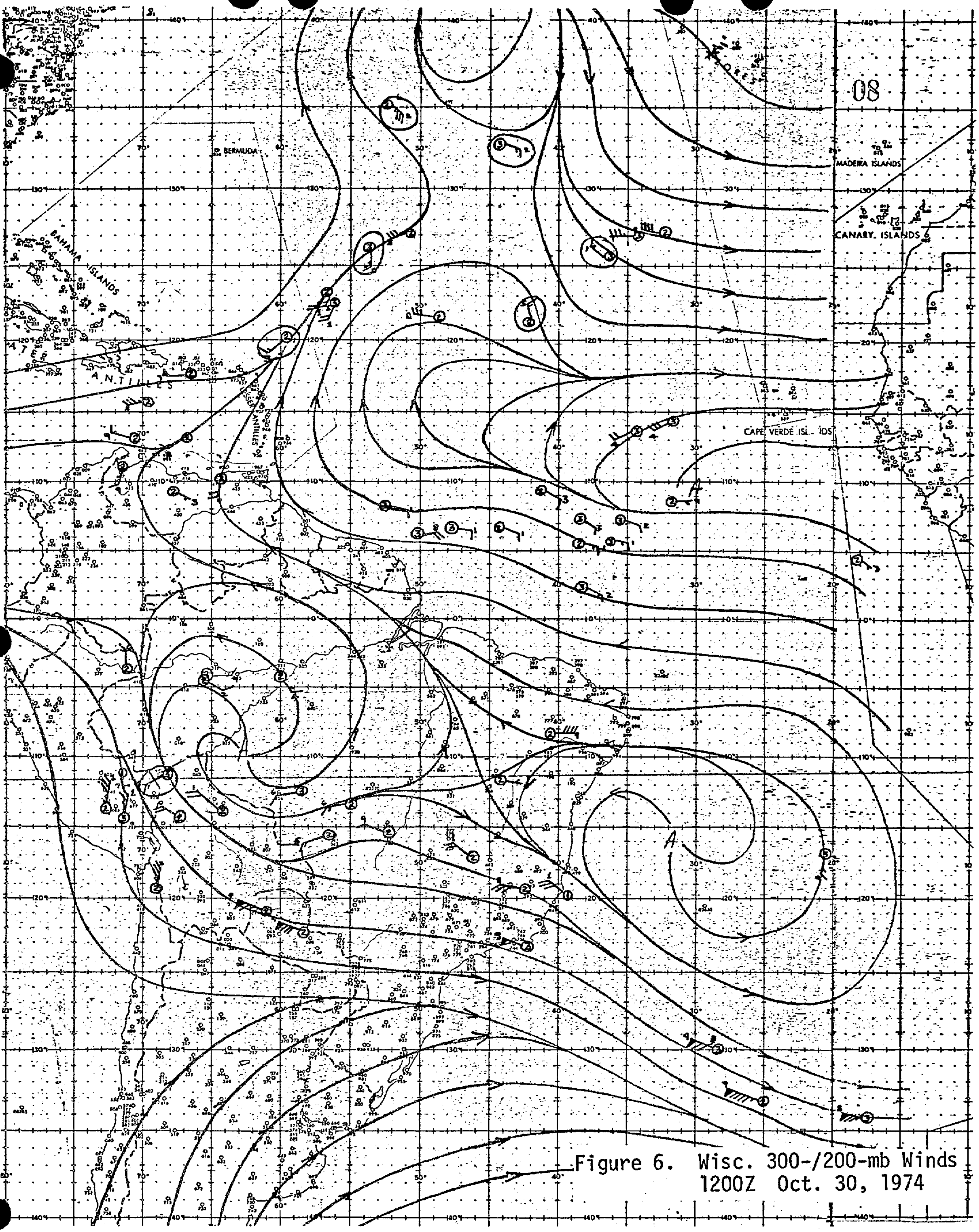


Figure 6. Wisc. 300-/200-mb Winds
1200Z Oct. 30, 1974

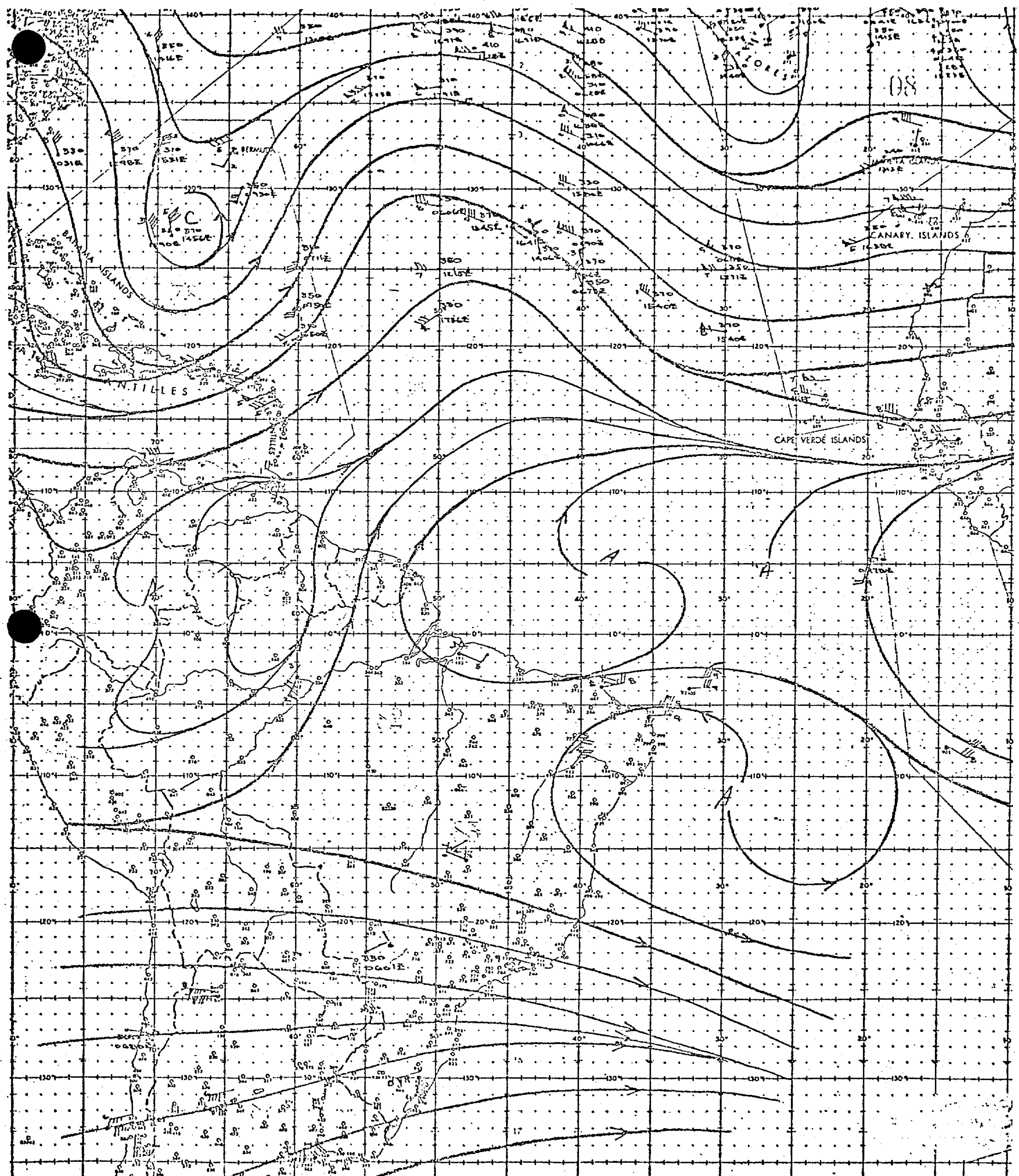


Figure 7. Raob and Aircraft 300-/200-mb Winds 1200Z Oct. 30, 1974

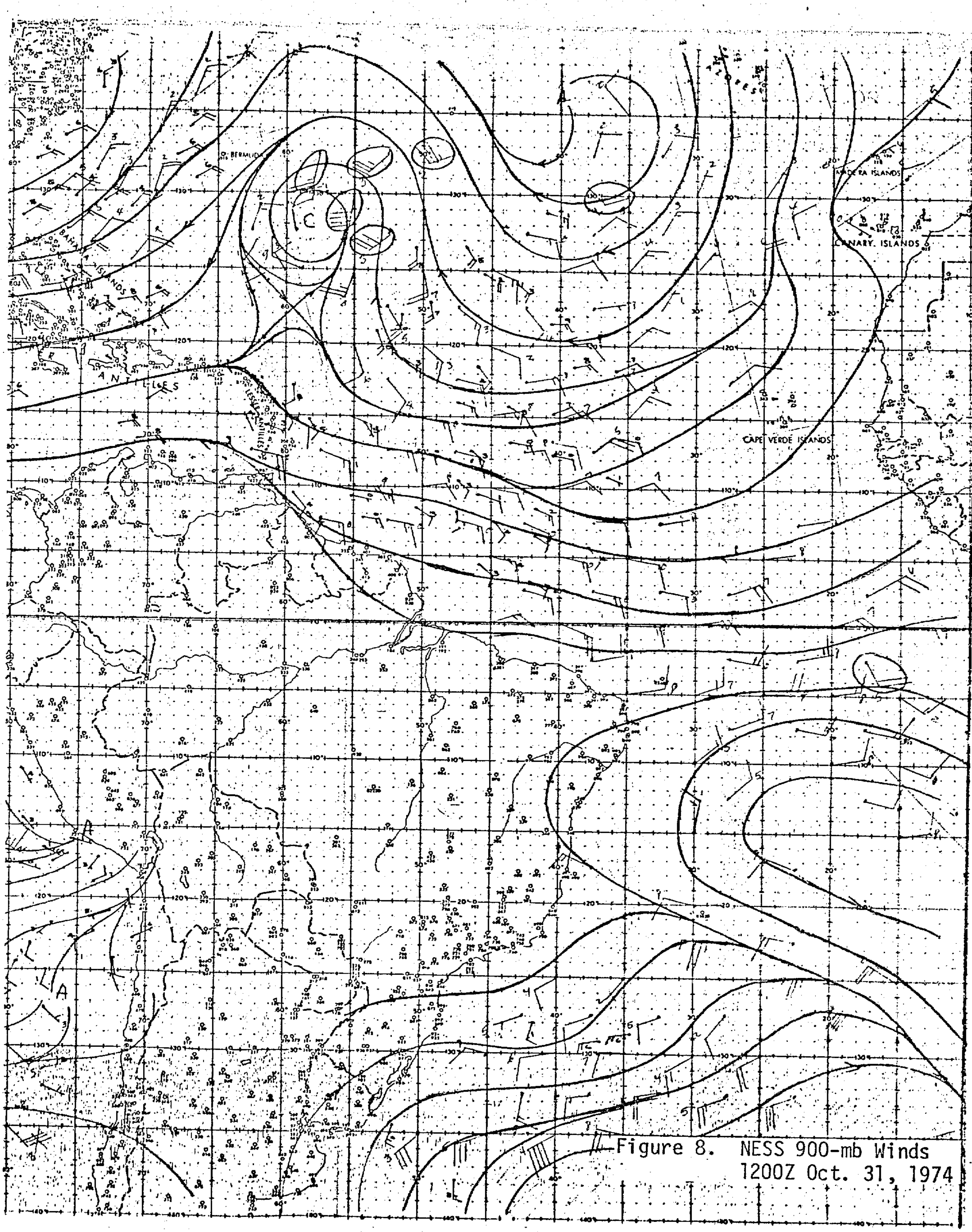


Figure 8. NESS 900-mb Winds
1200Z Oct. 31, 1974

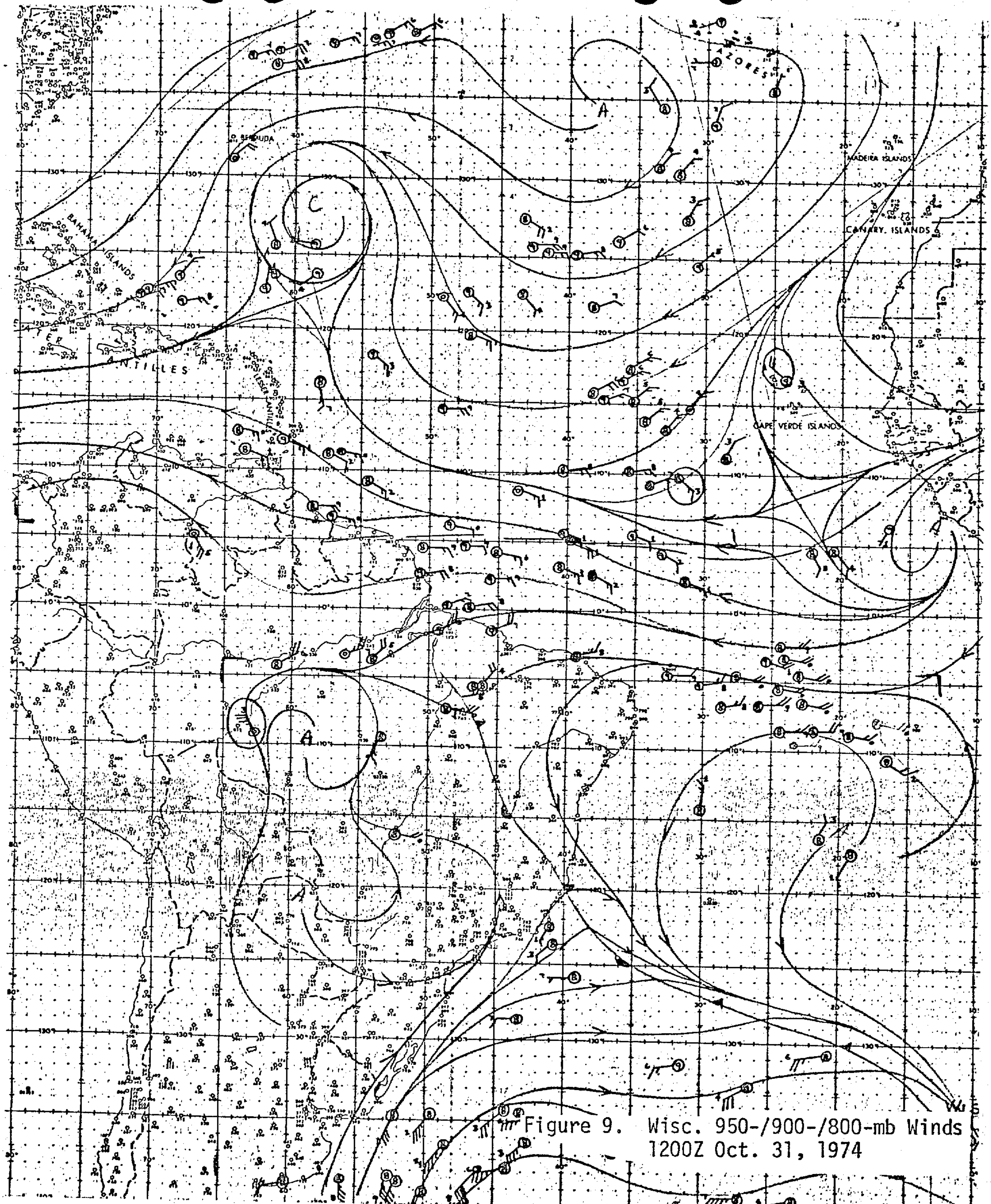
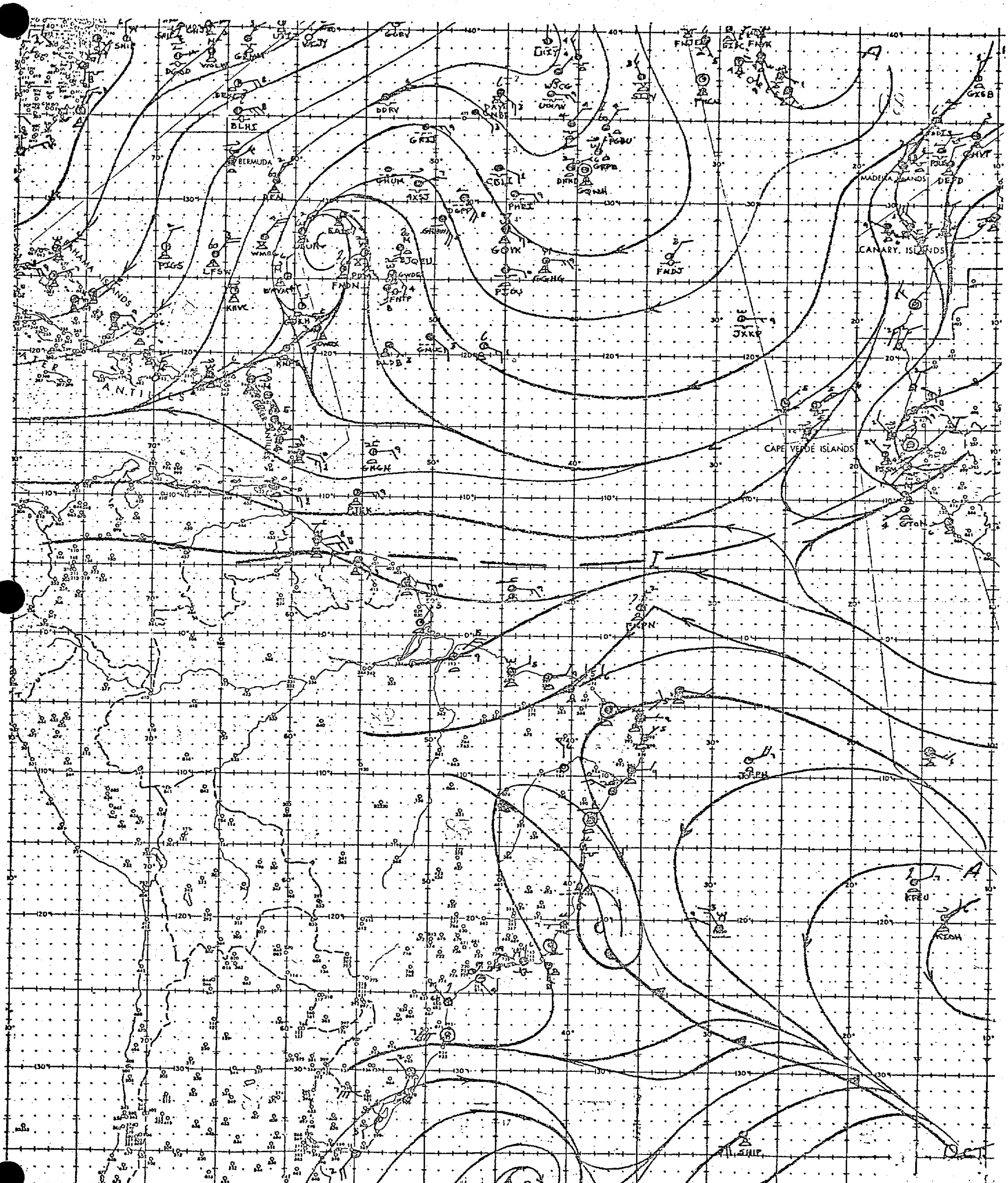


Figure 9. Wisc. 950-/900-/800-mb Winds
1200Z Oct. 31, 1974



Surface and Gradient Level Wind
Figure 10. 1200Z Oct. 31, 1974

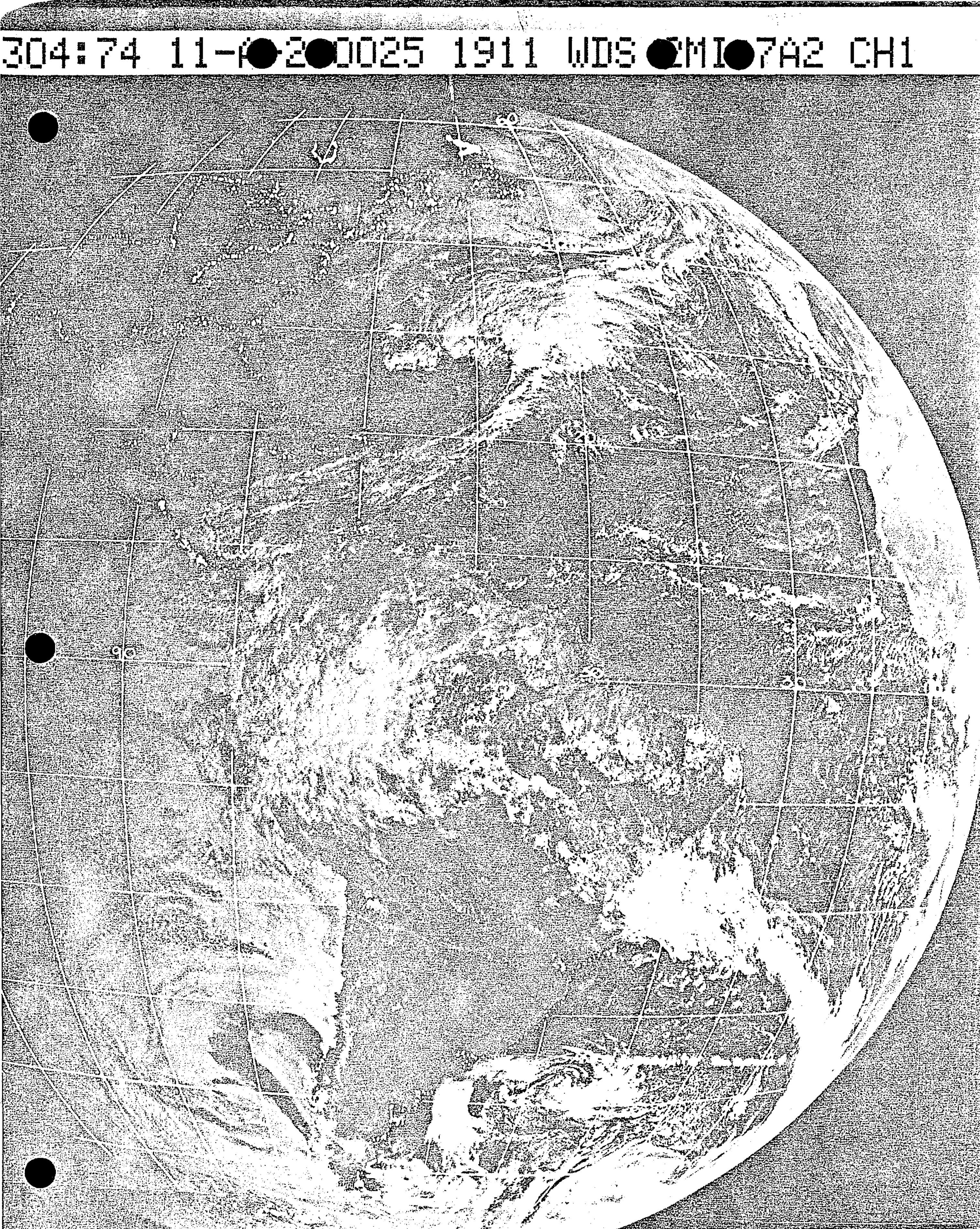


Figure 11a. SMS 1 Visible Range 2 n mi Resolution
1200Z Oct. 31, 1974

304:74 11-A 0020-1801 4X4 IR IMAGE

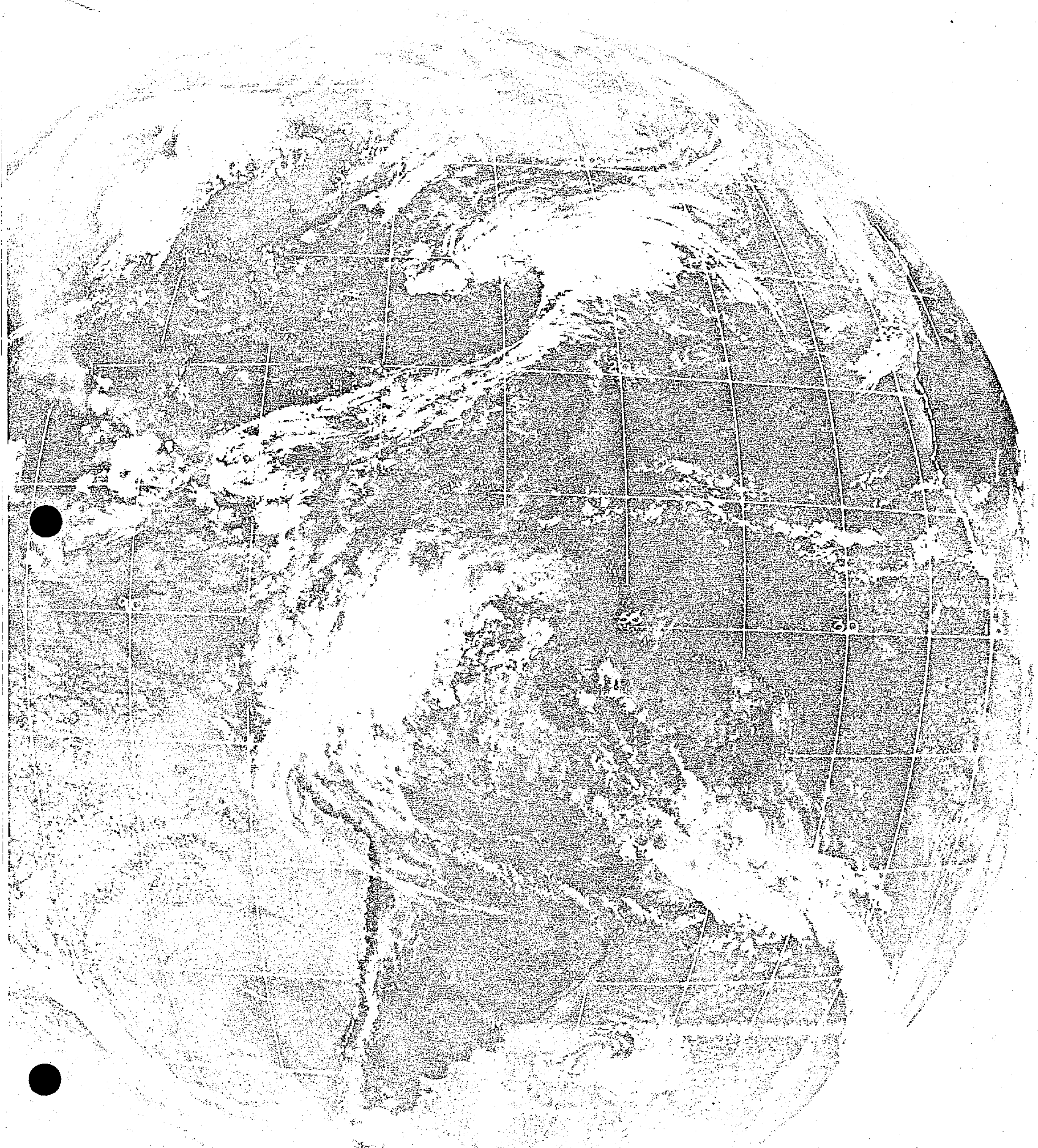
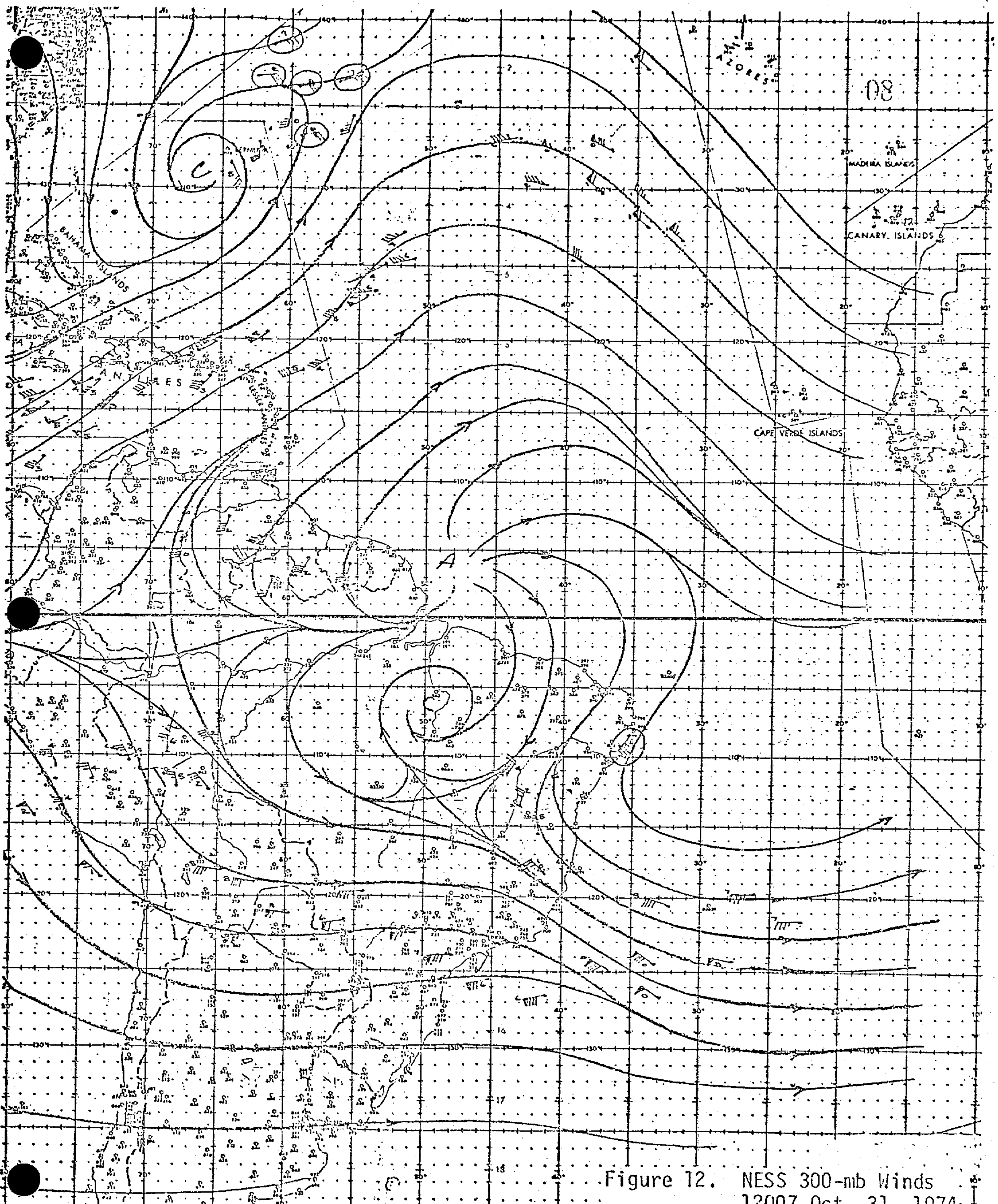


Figure 11b. SMS 1 Infrared Range 4 n mi Resolution
1200Z Oct. 31, 1974



08

Figure 12. NESS 300-mb Winds
1200Z Oct. 31, 1974

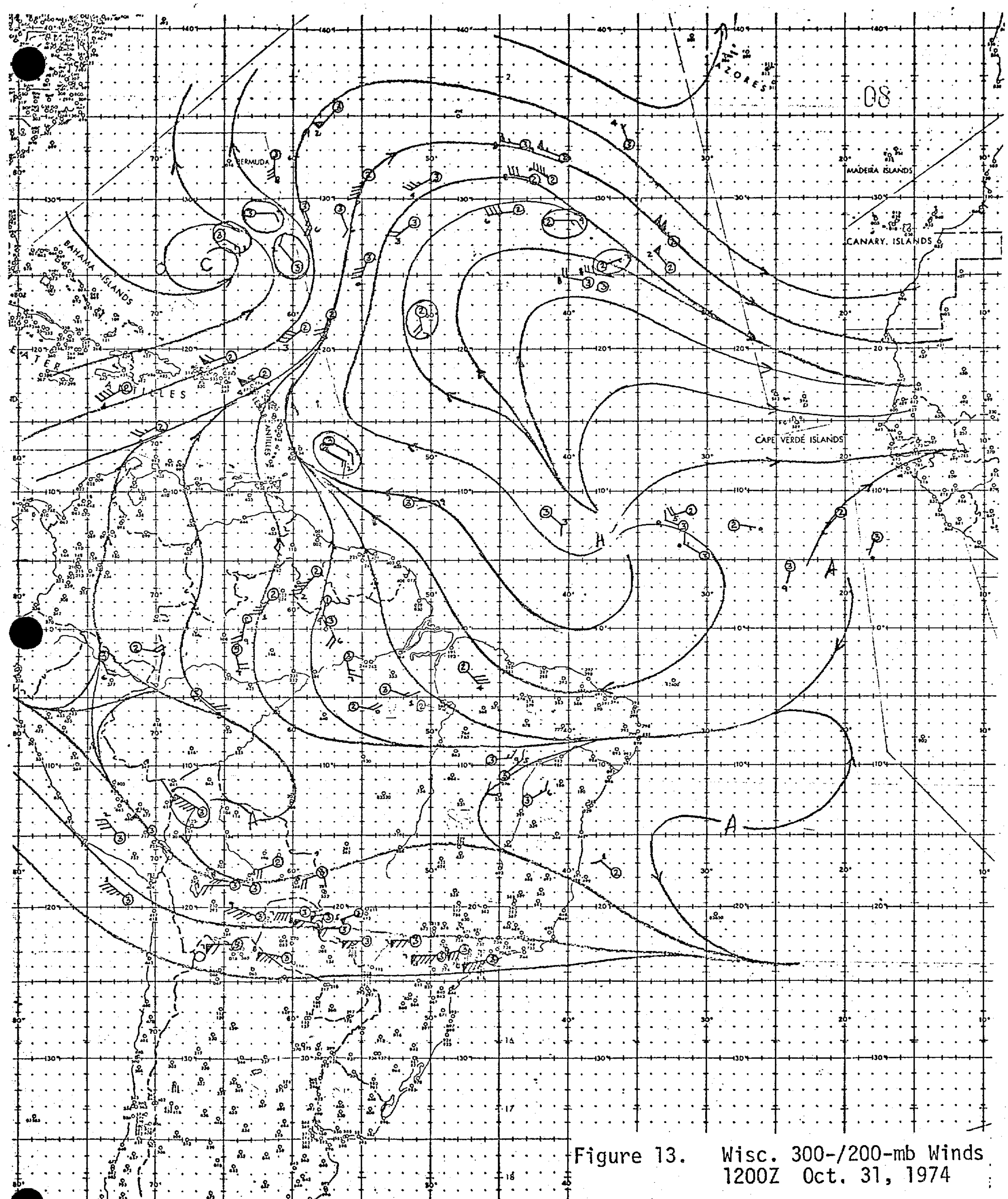


Figure 13. Wisc. 300-/200-mb Winds 1200Z Oct. 31, 1974

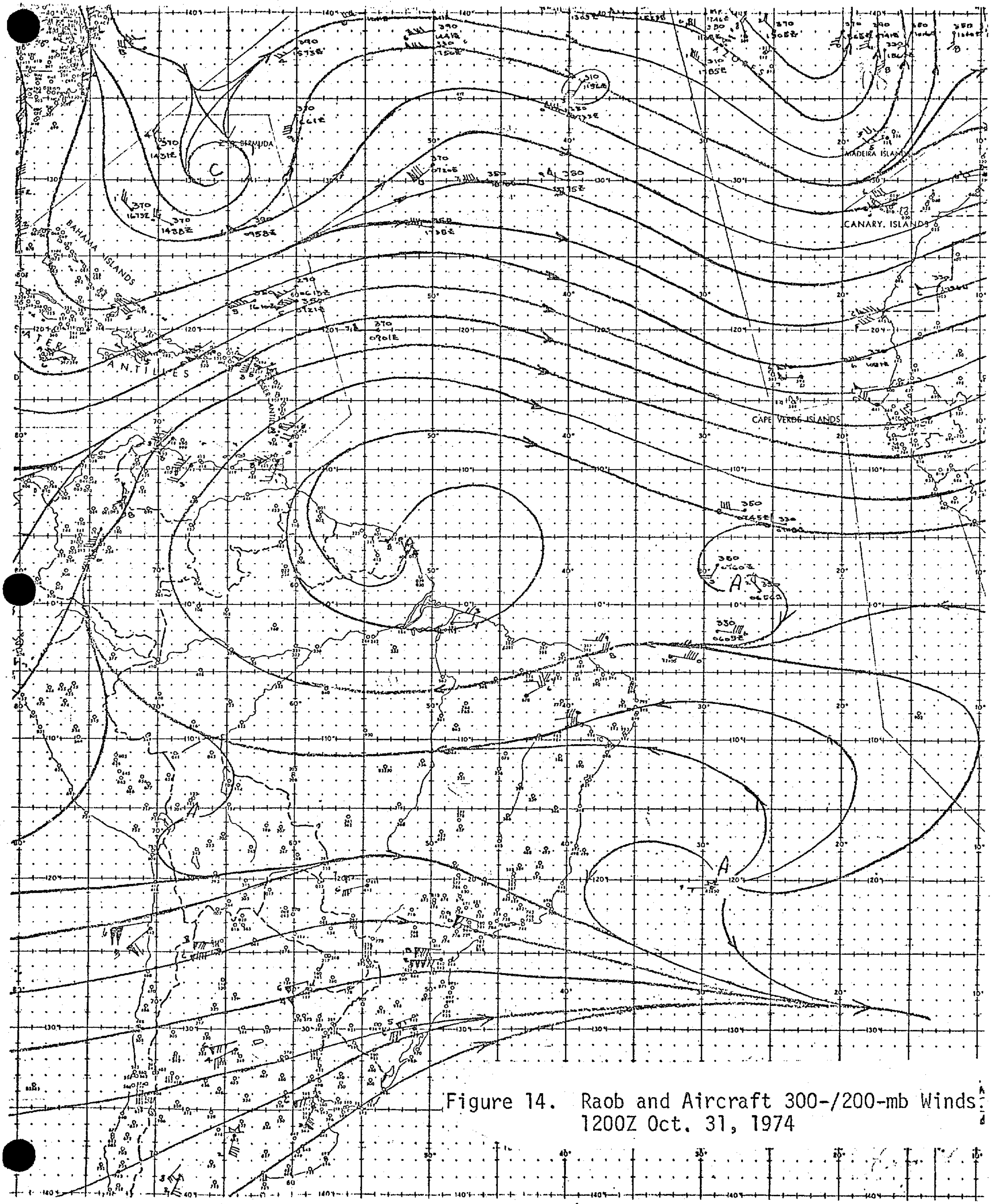


Figure 14. Raob and Aircraft 300-/200-mb Winds: 1200Z Oct. 31, 1974

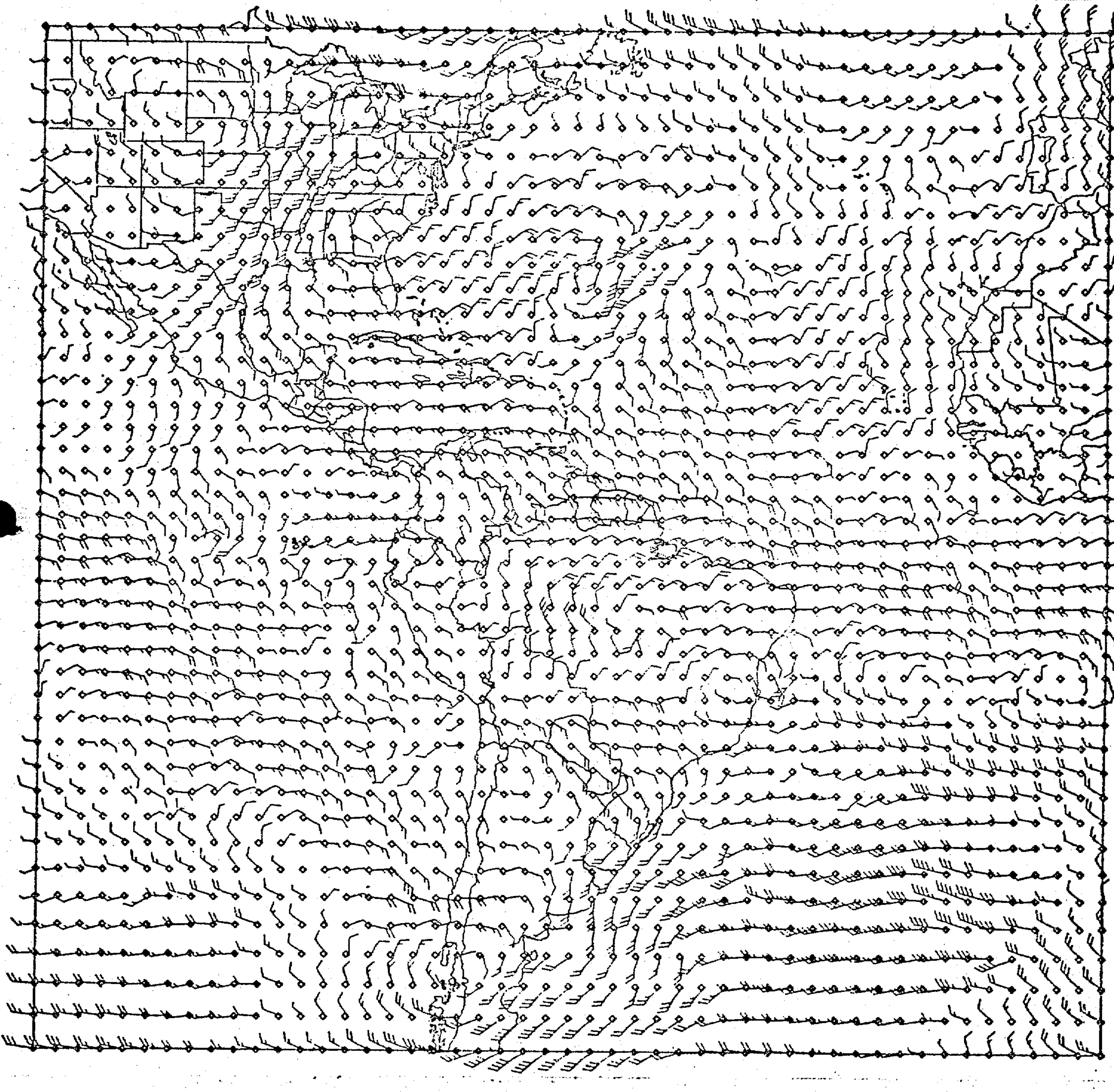


Figure 15. NESS and Wisconsin 850-mb Wind Analysis
(Not Error Checked) 1200Z Oct. 31, 1974

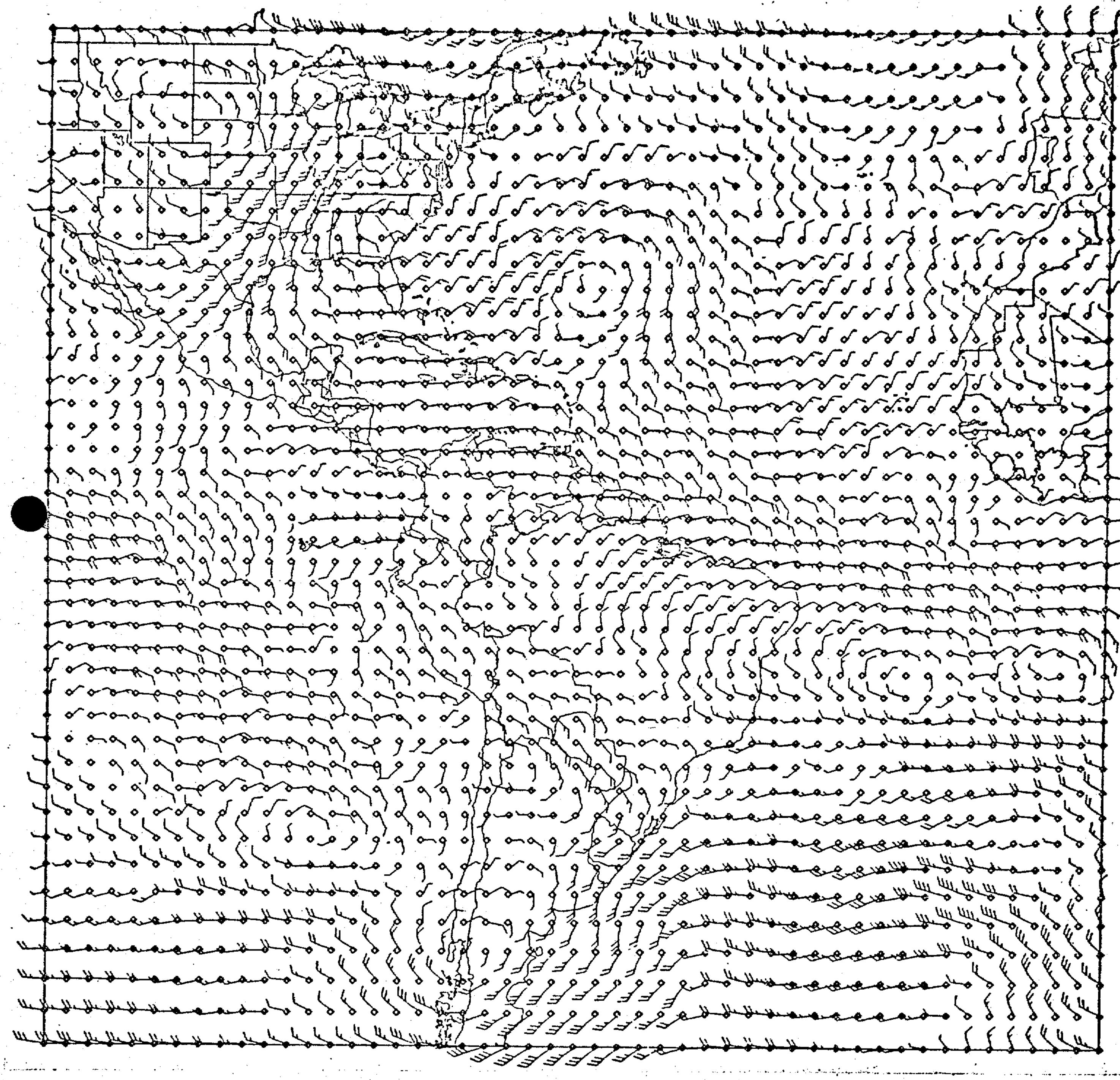


Figure 16. NESS and Wisconsin 850-mb Wind Analysis (Error Checked) 1200Z Oct. 31, 1974

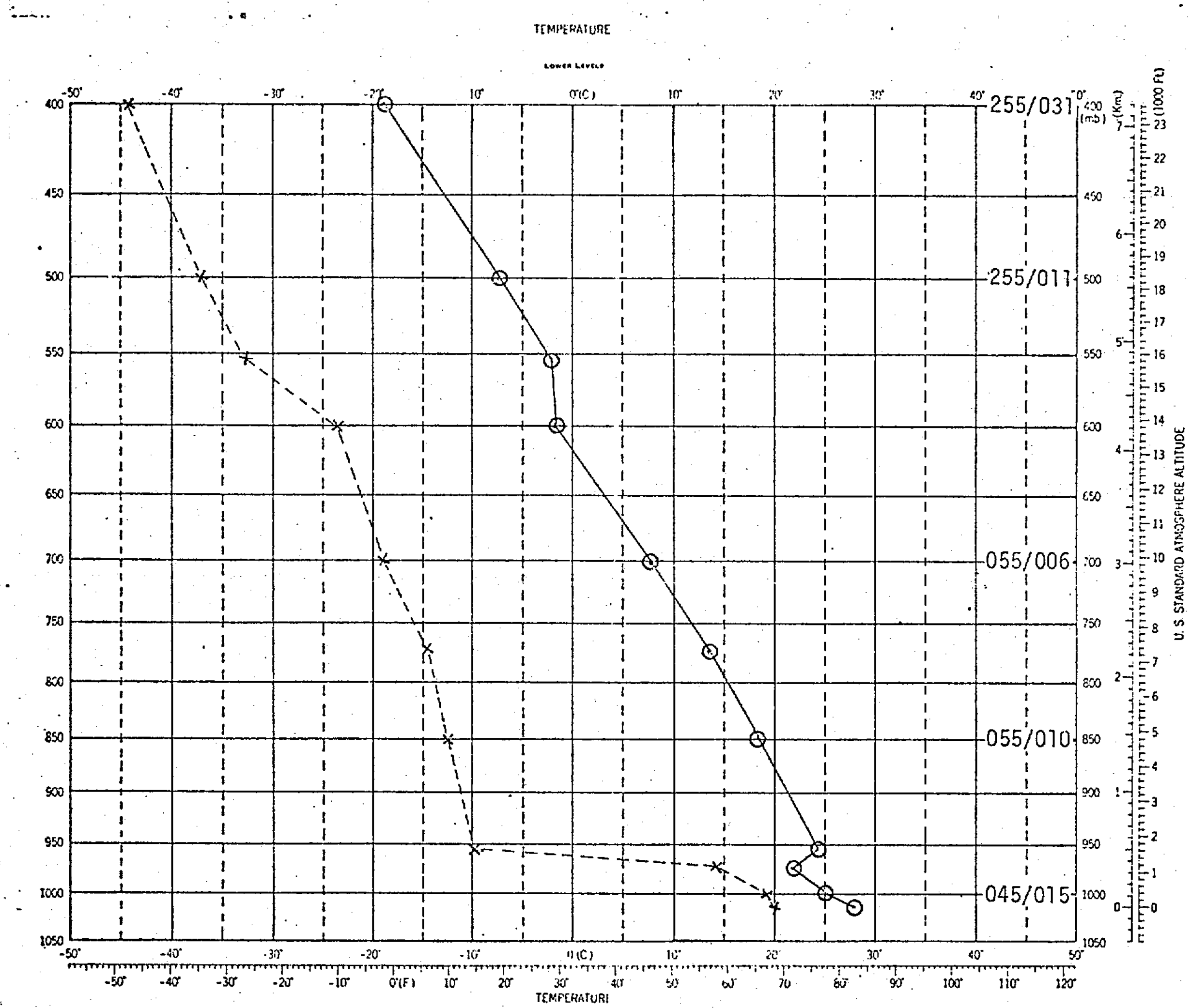


Figure 17. Station 08954, SAL, CAPE VERDE ISL (16.73N 22.95W)
1200Z Oct. 31, 1974

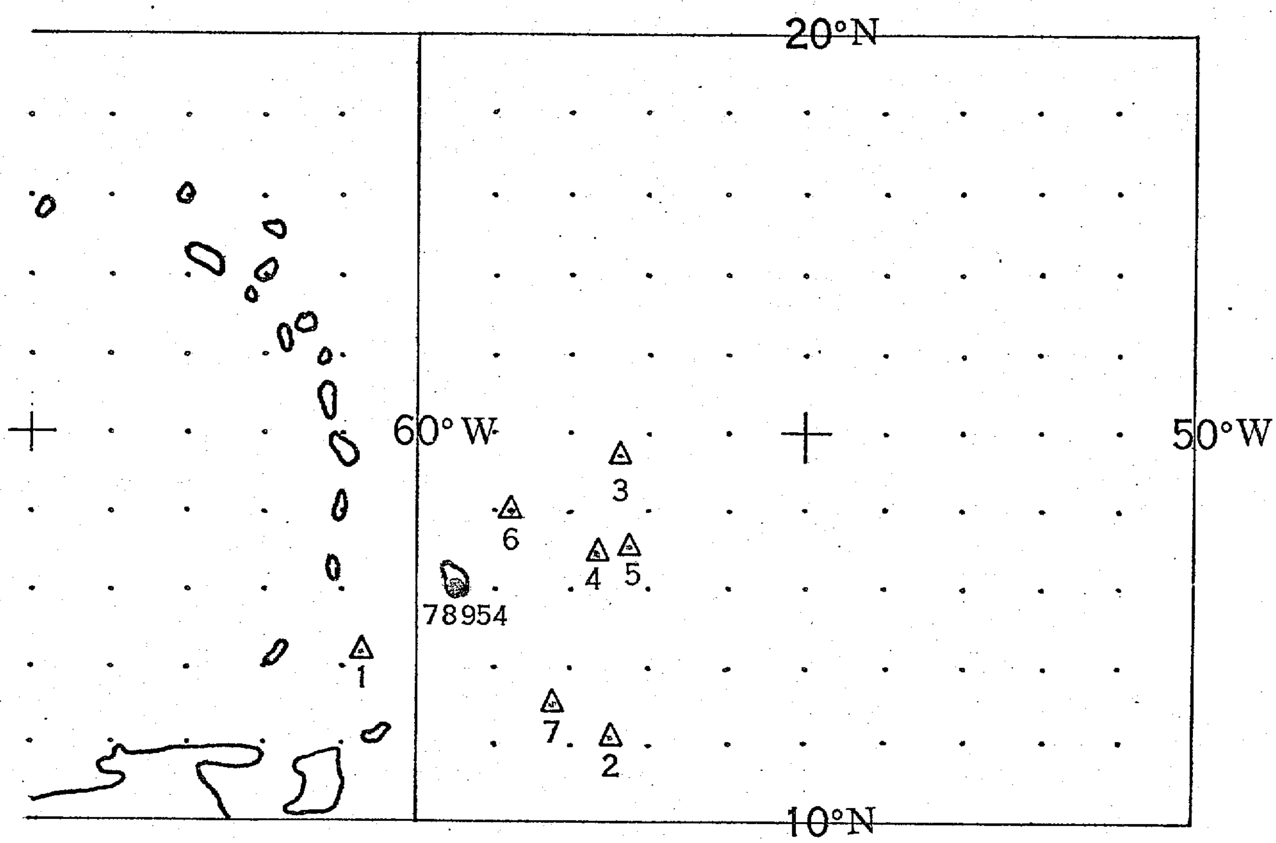
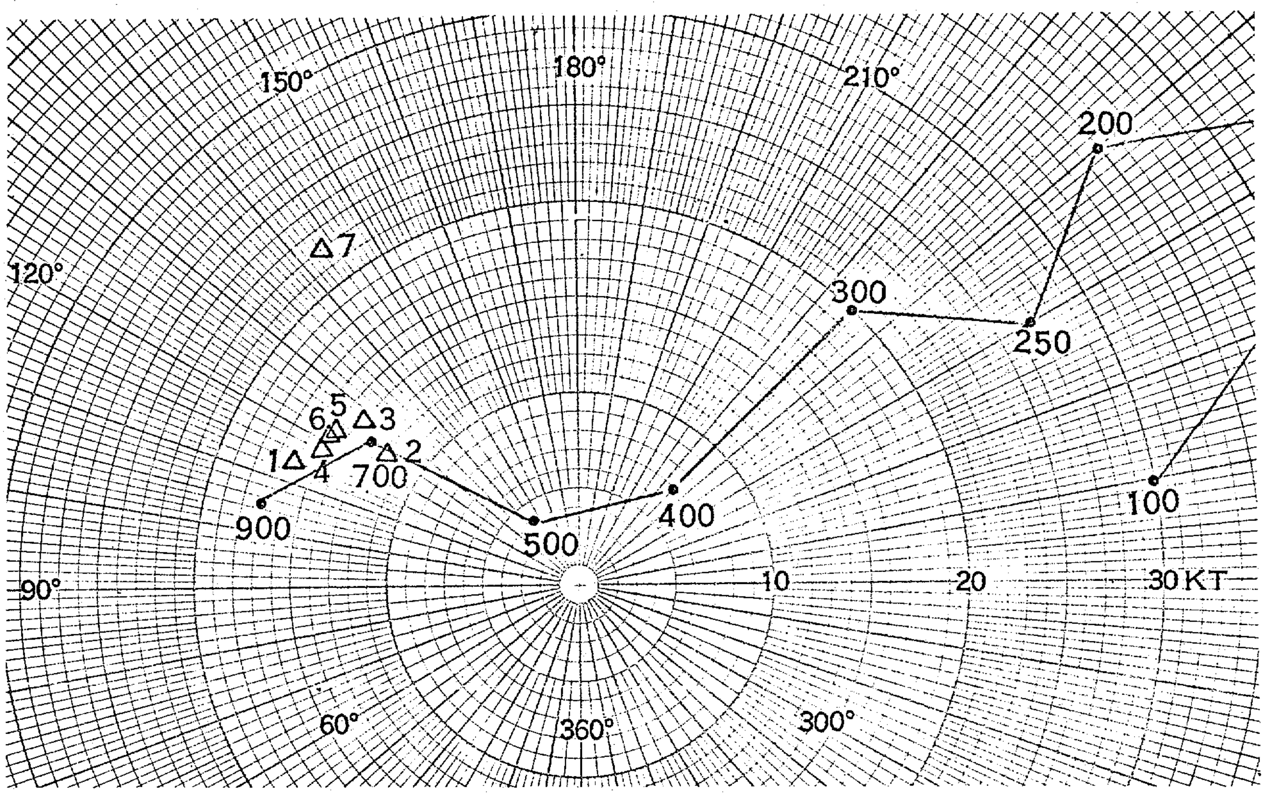


Figure 18. Map showing location of radiosonde station 78954 and the 7 Wisconsin winds graphed in figure 19.



	LAT. N	LONG. W	LEVEL (MB)	DIR. (DEG)/SPEED (KT)
1.	12.2	60.8	900	114/16
2.	11.1	57.5	800	124/12
3.	14.7	57.4	500	129/14
4.	13.4	57.7	300	119/15
5.	13.5	57.3	200	124/15
6.	14.0	58.8	100	122/15
7.	11.5	58.3	100	143/22

Figure 19. Hodograph of radiosonde winds of Station 78954 1200Z, October 31, 1974, and nearby Wisconsin wind vectors. Locations shown on figure 18.